



wwPDB X-ray Structure Validation Summary Report ⓘ

Dec 17, 2023 – 08:05 am GMT

PDB ID : 4B7O
Title : THE FrpB IRON TRANSPORTER FROM NEISSERIA MENINGITIDIS
(F5-1 VARIANT) APOPROTEIN FORM
Authors : Saleem, M.; Prince, S.M.; Derrick, J.P.
Deposited on : 2012-08-21
Resolution : 2.32 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.36
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

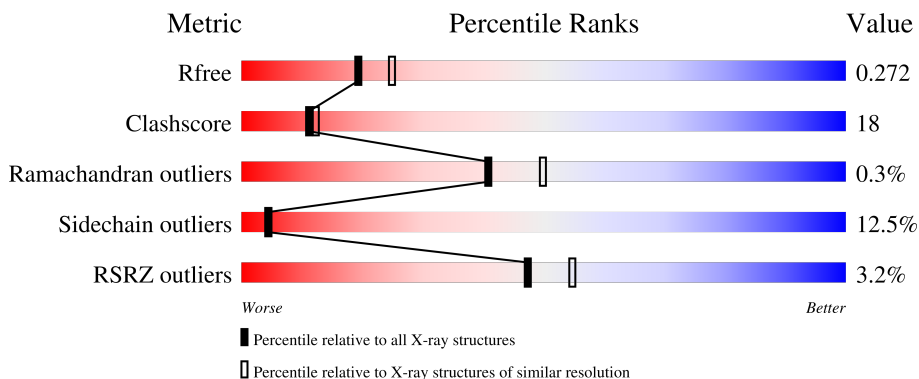
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.32 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5974 (2.34-2.30)
Clashscore	141614	6604 (2.34-2.30)
Ramachandran outliers	138981	6523 (2.34-2.30)
Sidechain outliers	138945	6523 (2.34-2.30)
RSRZ outliers	127900	5855 (2.34-2.30)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	745	

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 5182 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called IRON-REGULATED OUTER MEMBRANE PROTEIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	649	5103	3197	922	979	5	0	0	0

There are 76 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP Q841A2
A	2	HIS	-	expression tag	UNP Q841A2
A	3	HIS	-	expression tag	UNP Q841A2
A	4	HIS	-	expression tag	UNP Q841A2
A	5	HIS	-	expression tag	UNP Q841A2
A	6	HIS	-	expression tag	UNP Q841A2
A	7	HIS	-	expression tag	UNP Q841A2
A	8	SER	-	expression tag	UNP Q841A2
A	9	SER	-	expression tag	UNP Q841A2
A	10	GLY	-	expression tag	UNP Q841A2
A	11	LEU	-	expression tag	UNP Q841A2
A	12	VAL	-	expression tag	UNP Q841A2
A	13	PRO	-	expression tag	UNP Q841A2
A	14	ARG	-	expression tag	UNP Q841A2
A	15	GLY	-	expression tag	UNP Q841A2
A	16	SER	-	expression tag	UNP Q841A2
A	17	GLY	-	expression tag	UNP Q841A2
A	18	MET	-	expression tag	UNP Q841A2
A	19	LYS	-	expression tag	UNP Q841A2
A	20	GLU	-	expression tag	UNP Q841A2
A	21	THR	-	expression tag	UNP Q841A2
A	22	ALA	-	expression tag	UNP Q841A2
A	23	ALA	-	expression tag	UNP Q841A2
A	24	ALA	-	expression tag	UNP Q841A2
A	25	LYS	-	expression tag	UNP Q841A2
A	26	PHE	-	expression tag	UNP Q841A2
A	27	GLU	-	expression tag	UNP Q841A2

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Chain	Residue	Modelled	Actual	Comment	Reference
A	28	ARG	-	expression tag	UNP Q841A2
A	29	GLN	-	expression tag	UNP Q841A2
A	30	HIS	-	expression tag	UNP Q841A2
A	31	MET	-	expression tag	UNP Q841A2
A	32	ASP	-	expression tag	UNP Q841A2
A	33	SER	-	expression tag	UNP Q841A2
A	34	PRO	-	expression tag	UNP Q841A2
A	35	ASP	-	expression tag	UNP Q841A2
A	36	LEU	-	expression tag	UNP Q841A2
A	37	GLY	-	expression tag	UNP Q841A2
A	38	THR	-	expression tag	UNP Q841A2
A	39	ASP	-	expression tag	UNP Q841A2
A	40	ASP	-	expression tag	UNP Q841A2
A	41	ASP	-	expression tag	UNP Q841A2
A	42	ASP	-	expression tag	UNP Q841A2
A	43	LYS	-	expression tag	UNP Q841A2
A	44	MET	-	expression tag	UNP Q841A2
A	45	ALA	-	expression tag	UNP Q841A2
A	46	GLU	-	expression tag	UNP Q841A2
A	47	ASN	-	expression tag	UNP Q841A2
A	48	ASN	-	expression tag	UNP Q841A2
A	49	ALA	-	expression tag	UNP Q841A2
A	50	LYS	-	expression tag	UNP Q841A2
A	51	VAL	-	expression tag	UNP Q841A2
A	724	GLN	-	expression tag	UNP Q841A2
A	725	ARG	-	expression tag	UNP Q841A2
A	726	TRP	-	expression tag	UNP Q841A2
A	727	THR	-	expression tag	UNP Q841A2
A	728	ASN	-	expression tag	UNP Q841A2
A	729	THR	-	expression tag	UNP Q841A2
A	730	LEU	-	expression tag	UNP Q841A2
A	731	PRO	-	expression tag	UNP Q841A2
A	732	GLY	-	expression tag	UNP Q841A2
A	733	VAL	-	expression tag	UNP Q841A2
A	734	GLY	-	expression tag	UNP Q841A2
A	735	ARG	-	expression tag	UNP Q841A2
A	736	ASP	-	expression tag	UNP Q841A2
A	737	VAL	-	expression tag	UNP Q841A2
A	738	ARG	-	expression tag	UNP Q841A2
A	739	LEU	-	expression tag	UNP Q841A2
A	740	GLY	-	expression tag	UNP Q841A2
A	741	VAL	-	expression tag	UNP Q841A2

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Chain	Residue	Modelled	Actual	Comment	Reference
A	742	ASN	-	expression tag	UNP Q841A2
A	743	TYR	-	expression tag	UNP Q841A2
A	744	LYS	-	expression tag	UNP Q841A2
A	745	PHE	-	expression tag	UNP Q841A2
A	272	GLU	LYS	SEE REMARK 999	UNP Q841A2
A	302	PRO	SER	SEE REMARK 999	UNP Q841A2
A	638	ALA	THR	SEE REMARK 999	UNP Q841A2

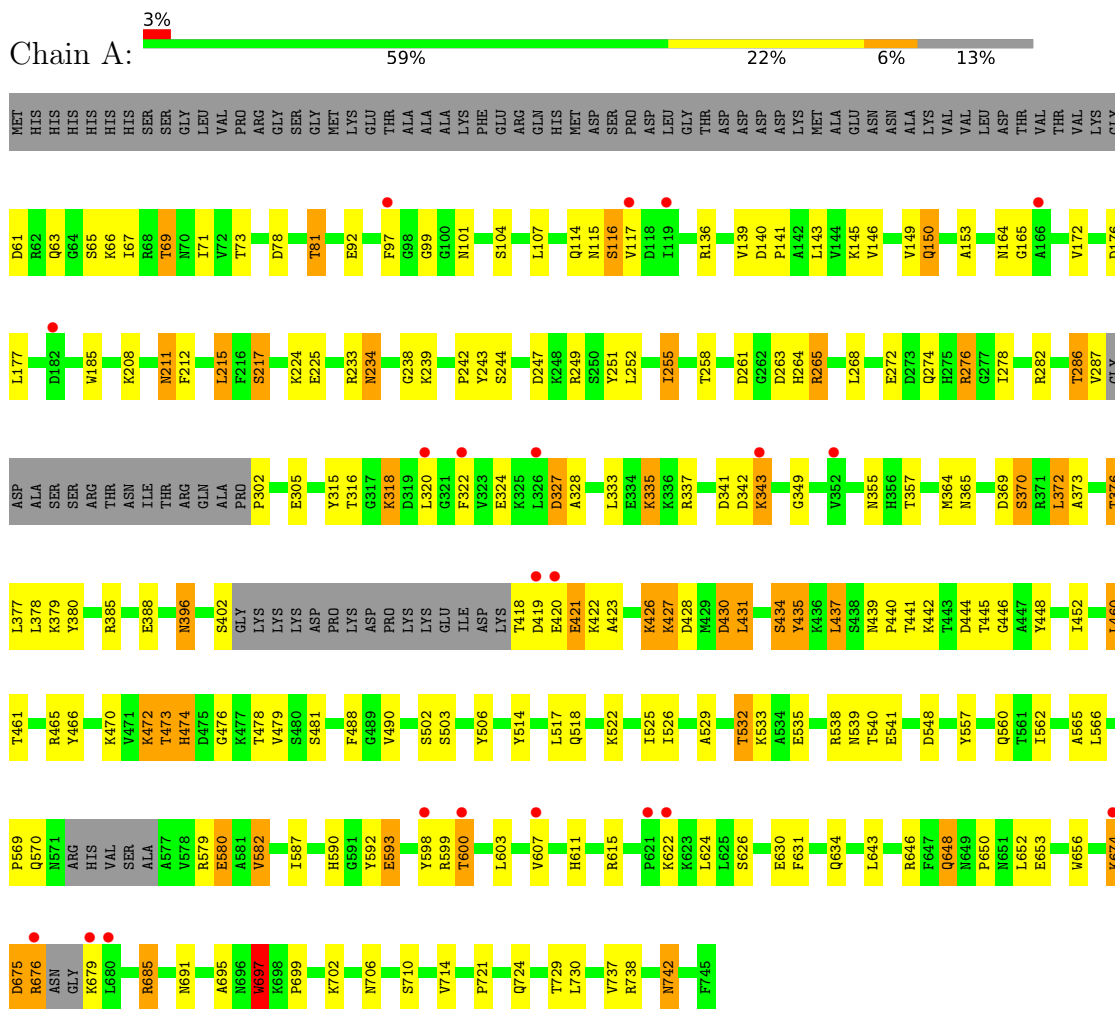
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	79	Total O 79 79	0	0

3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

• Molecule 1: IRON-REGULATED OUTER MEMBRANE PROTEIN



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	175.21Å 79.10Å 74.75Å 90.00° 97.58° 90.00°	Depositor
Resolution (Å)	37.05 – 2.32 37.05 – 2.32	Depositor EDS
% Data completeness (in resolution range)	98.0 (37.05-2.32) 98.0 (37.05-2.32)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.36 (at 2.31Å)	Xtrriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.233 , 0.281 0.228 , 0.272	Depositor DCC
R_{free} test set	2172 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	44.0	Xtrriage
Anisotropy	0.252	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 33.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5182	wwPDB-VP
Average B, all atoms (Å ²)	45.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.50% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
1	A	0.91	3/5210 (0.1%)	0.95	7/7027 (0.1%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	697	TRP	CD2-CE2	7.64	1.50	1.41
1	A	185	TRP	CD2-CE2	6.30	1.49	1.41
1	A	92	GLU	CD-OE2	5.82	1.32	1.25

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	685	ARG	NE-CZ-NH1	6.77	123.69	120.30
1	A	385	ARG	NE-CZ-NH2	-6.20	117.20	120.30
1	A	685	ARG	NE-CZ-NH2	-5.93	117.33	120.30
1	A	697	TRP	CA-CB-CG	5.89	124.89	113.70
1	A	646	ARG	NE-CZ-NH2	-5.50	117.55	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	5103	0	4945	180	0
2	A	79	0	0	22	0
All	All	5182	0	4945	180	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 18.

The worst 5 of 180 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:615:ARG:HH12	1:A:634:GLN:NE2	1.38	1.19
1:A:316:THR:HB	2:A:2041:HOH:O	1.40	1.18
1:A:427:LYS:HB2	2:A:2052:HOH:O	1.49	1.10
1:A:265:ARG:HB3	2:A:2041:HOH:O	1.56	1.06
1:A:81:THR:HG21	1:A:710:SER:OG	1.55	1.05

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	639/745 (86%)	613 (96%)	24 (4%)	2 (0%)	41 50

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	234	ASN
1	A	675	ASP

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	535/615 (87%)	468 (88%)	67 (12%)	4 4

5 of 67 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	607	VAL
1	A	648	GLN
1	A	737	VAL
1	A	364	MET
1	A	357	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	634	GLN
1	A	691	ASN
1	A	742	ASN
1	A	724	GLN
1	A	264	HIS

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	649/745 (87%)	0.20	21 (3%) 47 55	29, 43, 61, 88	0

The worst 5 of 21 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	680	LEU	4.6
1	A	621	PRO	3.8
1	A	320	LEU	3.6
1	A	322	PHE	3.4
1	A	117	VAL	3.4

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.